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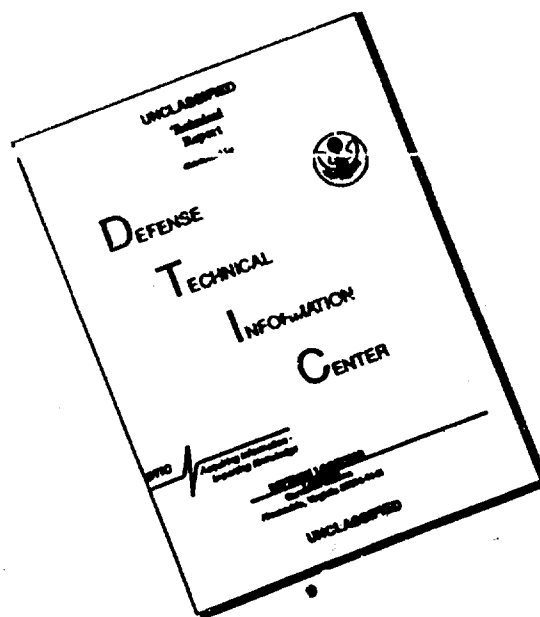
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## THE SCRUB BARRENS OF CENTRAL ASIA

Ti-li I-pao  
[Journal of Geographic Translations]  
No 3, August 1957, Peiping,  
Pages 150-155  
Chinese, per

E. N. Balagovezhskiy

Many scientific investigators have pointed out that the plant cover of the various regions of Central Asia's barrens is extremely varied. B. A. Fedechenko (Fei-te-ch'in-ko), M. G. Popov (Po-pu-fu), P. I. Abolin (A-po-lin), E. P. Goloven' (K'o-lo-wen'), and A. V. Pulotsolovskiy (P'u-lo-tso-lo-fu-sso-chi) have all distinguished different types of "typical barrens" (according to meteorological factors). However, for the majority of investigators this kind of distinction is geographical in nature. For example, in E. P. Goloven' latest publication, he divides barrens into "Mediterranean" (where spring rainfall is greatest), and "Central Asian" (where summer rainfall is greatest).

The most useful principles for the division of Central Asian barrens into zones are found in the works of the late A. V. Pulotsolovskiy. The author has only taken those plant complexes in which dry-growing small scrub is dominant and classified them as "true barren" plant cover.

A. P. Pulotsolovskiy (in the opinion of A. P. Shchenikov) believes that plant complexes dominated by short-lived and similar plant life should not be considered barren-type plants but should be called "warm weather dormant grass lands," although short-lived plants are one of the great characteristics of barrens. Everyone knows that even in the Chekhala barren where there are periods of several years without rain, there is a luxuriant growth of short-lived plant cover (Asheb) immediately after a heavy rainfall. Therefore, if we use the principles of A. P. Shchenikov and Pulotsolovskiy the Chekhala should be classified as a "warm-weather dormant grass land" zone.

A barren is a geographical concept. To be classified as a barren, an area should have very slight rainfall (under 250 mm) and a calcareous top soil (the top soil is often very meagre). The most outstanding botanical characteristic of barrens is the invariable presence of dry-growing scrub and small scrub, although these plants are not necessarily dominant. These plants have many different kinds of organs adapted to living under unfavorable conditions: hard-leaved types, succulents, "short-lived types." For this reason, extremely different plant types, from short-lived plants to cactus, may be dominant in barren areas. There is also the view that, from the point of view of "botanical geography" barrens should be considered as "sparse" plant complexes (Irmoskiy, I-erh-mo-sso-chi). This view is based on a misconception since this sparse barren vegetation is actually very close together underground where the root systems intermingle.

However, when analysing "small scrub" types of vegetation (A. V. Pulotsolov believes these are the special characteristic of the plant cover of barrens), it will be noted that dominant plant types are distributed according to differing geographic zones. In the northern part of the barren region, for example, the dominant type is short small scrub (artemisia). We suggest that what are known as the relatively large barren scrub plants (Calligonum, Haloxylon) are seen only where there is soil with good water distribution (sandy).

In areas somewhat further south, this type of plant is everywhere dominant in almost all barrens, and artemisia-type small scrub is generally not seen (east Kara-Kum) and only grows as the lower stratum of the barren scrub vegetation.

Since the time of Borshchov there has been a widely current opinion that the scrub of the Central Asian barrens grows only in sandy ground, this is not entirely correct.

In reality, the most "luxuriant" barren-scrub types--Haloxylon and Calligonum--generally grow in gravelly or sandy soil that is comparatively moist. However, the dominant plant types in arid soils should also be classified as barren-scrub types (although on the basis of height they are somewhat smaller than Haloxylon and Calligonum). For example, the small Haloxylon aphyllum is widely distributed in fissured saline soils; together with the pig-bristle plant (Salsola arbuscula) it is often dominant on high gravelly plains.

From the Guchen corridor eastward, under similar environmental conditions, Haloxylon ammodendron is generally dominant.

In the south, the most commonly seen types of scrub in the salt marshes are Halostachys, Tarmarix, and Nitralia.

This situation is even more apparent in the new world. In the arid regions of America, artemisia barrens are dominant between latitudes 44° and 38°, but to the north the vegetation is a short type of artemisia (Artemisia nova); in the south it is the scrub-type Artemisia tridentata. Somewhat further south (between latitudes 37° and 35°), the dominant growth is made up of higher scrub-type plants (Parkinsonia, Covillea, Fouquieria). Those which are most similar to the scrub barrens of central Asia are the Artemisia tridentata types. (The lower stratum of plant life consists of Carex stenophylla, Bromus tectorum, Aristida fenderiana, Lepidium jonessii, etc.)

Scrub barrens are also unusually widely distributed in central Australia.

We are of the opinion that those plants which are perennial, have woody parts above ground, have a stalk at least one meter in height, and can grow in places having unusually light rainfall (below 200 mm) and a low water table (below 15 meters) should be classified as barren-scrub types. A. V. Pulotsolovskiy classified a large part of the scrub of central Asia's barrens (*Calligonum*, *Haloxylon*, *Eremosparton*) as semi-scrub because parts of the plant were dropped every year. We do not believe, however, that this kind of characteristic is sufficiently important to be taken as the basis for an ecological classification. The most common ecological characteristic of the plant life of barrens is that they have all developed very strong root systems. They generally penetrate a volume of several dozen cubic meters of soil. Among these there is one type with an especially deep root system (*Tamarix*). It is not proper to apply the designation "semiscrub" to plants which, under suitable conditions can reach a height of 2 to 3 meters (sometimes even higher). In foreign writings the above-mentioned plants are all referred to as scrub (shrub, bush, strach). Even if "deciduousness" were one of the important characteristics, the designation "semiscrub" would not be suitable for application to deciduous scrub.

Borshchov pointed out long ago (1867) that barren scrub is a characteristic element of the plant region from the Caspian Sea to the Aral Sea.

The more than 50 types of scrub which grow here are divided among the following genera: *Ephedra*, *Calligonum*, *Haloxylon*, *Salsola*, *Seidlitzia*, *Ammodendron*, *Eremosparton*, *Smirnovia*, *Spiraeanthus*, *Nitraria*, *Zygophyllum*, *Tamarix*, *Reaumuria*, *Lycium*.

Barren-scrub is a type of thick-growing, comparatively short-lived herbaceous plants and Asian artemisia-type small scrub. The growth of the scrub stratum is usually above the small scrub or herbaceous stratum in stratified plant complexes. For this reason, we believe that the view which divides the Turan Barren, in which the upper-stratum growth is almost entirely the same, into northern and southern regions principally on the basis of differences in lower-stratum plants is not correct.

If we were to use this division here, then the Mo-yun--K'u-mei Haloxylon, and the K'o-tz'u-erh-k'u--K'u-mei Haloxylon would become different Asian zones (M. G. Popov, E. P. Goloven', A. V. Pulotsolovskiy).

Looking at the problem from another aspect, in the maps published by E. P. Goloven' and A. V. Pulotsolovskiy only the short-lived-plant Asian barren zone (or type, according to Goloven') would be applicable to the western portion of Turan, since everyone knows that the short-lived-plant barren zone is not present on the eastern edge of the Asian barren zone.

However, in our view, there is not the slightest doubt that the Guchen and Alashan' Barrens also have zonal distinctions, namely, that the distribution of scrub groups is in comparatively southerly areas.

This type of scrub barren distribution cannot be explained on the basis of rainfall conditions.

In reality, the plant cover in foothill regions of central Asia is determined in many instances by the amount and seasonal distribution of rainfall. In these areas, the types distinguished by E. P. Goloven' ("Mediterranean" and "Central Asian" barrens) are entirely applicable.

In the central Asian lowland barrens, no relation can be found between distribution of rainfall and distribution of scrub groups. In the Guchen region at longitude 90° and in the Yar-Adzhi (T'u-ku-man) region far to the west at longitude 30°, the dominant plant cover is of the same type. However, to the east the rainfall is generally more than 200 mm, while in the western area the rainfall generally does not reach 100 mm. In several areas, scrub is dominant under conditions of very little rainfall; while in other areas where rainfall is relatively great, scrub is not seen. For example, in the northern portion of Kara-Kum (rainfall about 80 mm) the growth consists of haloxylonates, while in the southeast portion of Kara-Kum (rainfall about 150 mm), haloxylonates are not seen.

As seen in the appended figure, barren-scrub type plants are distributed in the extremely arid areas of Asia. At the same time, it should not be doubted that the amount of water required annually by scrub types is greater than that required by other barren-type plant groups. Where scrub barrens and other types of barren are intermingled, scrub usually grows in places where the soil is damp—sandy soil, dry river beds, etc. This phenomenon is also observed in Africa, America, and Australia.

For this reason it must be recognized that barren-scrub, in order to grow successfully under these difficult conditions, must utilize frozen water as well as water which falls from the atmosphere.

If we say that the life of perennial plants in the mountain and foothill areas of central Asia is determined by the amount and restriction of rainfall, then we must also say that the life of barren lowland plants is determined by their ability to utilize frozen water.

Our investigations into the problems of atmospheric water vapor freezing in the soil, which were carried out from 1938 to 1946 in the eastern Kara-Kum, proved that the presence of a layer of moisture of two to five meters depth in the soil at Lepicheko and Iolotan' could be explained solely on the basis of the process of freezing water. Therefore, barren-scrub can obtain the water necessary for maintaining growth during the summer from this layer.

the summer, parts of the plant drop off (in order to minimize evaporation). It is clear that in the short summer of the north (for example, in October at Chenmir the roots already penetrate the soil to a point where the temperature is as low as  $5^{\circ}$ ), cannot build up enough organic matter to maintain the necessary life processes.

The Asian scrub barren zone has its northern limit strictly determined—north of the line indicating an average annual temperature of  $8^{\circ}$  (soil temperature is  $11^{\circ}$  in this area), scrub growth is seen only in sandy ground, and north of the  $6^{\circ}$  isotherm there is absolutely no trace of it.

The southern limit is not clearly defined. South of the limit, scrub may be seen not only in sandy ground but also in swampy ground under unusual conditions of water distribution. Under these conditions, some barren-scrub is even seen in tropical regions; for example, the *Calligonum polygonoides* and *C. comosum* of the Tar (T'a-erh) and Lubukhali (Lu-pu-o-ha-li) sandy deserts. In the areas immediately adjacent to the limits of the Asian zone, large areas of haloxylonates are often seen in the swampy areas on the edges of lakes. Haloxylonates as tall as these are also seen at Kolashe of Guchen and the black haloxylonates of Shengstan (Sheng-su-t'an) and North Baluchi are even taller.

In western Turan, the scrub barren zone of Asia and the short-lived plant barren zone of Asia meet. In Sinkiang, south of the Asian scrub barren zone, there is the great Gobi which has been called completely lifeless by all investigators. It cannot be doubted that in the great Gobi there are relatively large areas without plant life. There are some places, however, that are occasionally covered with an especially sparse barren-scrub. For example, the dominant growth in central Iran is this type of barren (according to M. P. Bidilov, short-lived plant barrens do not cover a large area here). Therefore, the southern small-scrub barrens are of a different type, characterized primarily by sparseness and next by the fact that the small-scrub elements are of peculiar types. *Artemisia* is almost lacking, and dry-growing plants (*Ephedra*, *Reaumuria*, etc.) become more common.

Finally, near the tropics (Tar and Lubukhali) the barrens belong to a special Asian zone which is very appropriately called the graminaceous plant zone. In the plains, the plant cover is mainly composed of tropical, dry-growing graminaceous plants (represented by *Andropogon*, *Panicum*, *Aristida*). Without the slightest doubt, the plant cover of this type of plain has the general characteristics of a dry, hot, tropical plain with few trees and dry grasses. However, because of the extreme sparseness of the plant complexes, they cannot under any circumstances be classified as plains having few trees and dry grasses or as grassy plains, and they must be considered as a special type of barren.

When we examine these areas from the aspect of botanical geography, we must recognize that these areas not only have a "right to exist" (when compared with other Asian zones) but also that they comprise a completely unique zone.

The tropical graminaceous plant zone of Asia has been very little investigated. On the basis of several sources, however, it can be seen that this area is quite rich in types, although it should be explained that there are few unique types here; the great majority of types are the same as, or similar to, those found in dry, hot, grassy plains with few trees. It can be seen at a glance that there are few types of plants uniquely adapted to sandy ground here (vanguard plants); the sand hills of the tropics and the Asian subtropics are lacking in natural plants everywhere.

The plants found in the short-lived plant barrens are, in reality, no more than the overflow of Mediterranean plant types. The genuses seen here, and almost all the species, are also seen on the Mediterranean coast (but certainly not under barren conditions). In the shifting sands of this Asian zone there are also extremely few "vanguard" plants adapted to living in sand.

Among the various types of plants found in lowland scrub barrens there are quite a few unique plants, but almost all of these are unique families (Vidovii rang).

The most important of the special types seen here are the *Chenopodium* including *Nanophyton*, *Horaninovia*, and even *Londesia*, *Bienertia*, *Iljinia*, *Simpegma*, etc. The *Polygonum Atraphaxis*, according to a relatively correct point of view, can be considered an element of the plants of mountainous areas, while *Calligonum*, *Eremosparton*, *Ammodendron*, and *Tamarix* have their own centers of development somewhat further south. The areas of shifting sand in this Asian zone also lack plant cover unique to themselves. The plant cover in many instances is made up of representatives of plants of the grassy plains (*Salix rosmarinifolia*, *Festuca beckri*, *Stipa joannis*) and some of the representatives of the barren-scrub of the Asian zone (*Calligonum*, *Eremosparton*).

It is characteristic of the Asian scrub zone that it has a large number of plants of unique genus, while these genuses are divided into quite a few species. Among the unique genuses of barren-scrub are *Calligonum* (*Polygonum*), *Haloxylon*, *Seidlitzia* (*Chenopodium*), *Ammodendron*, *Eremosparton*, *Smirnovia*, *Halimodendron* (leguminous). "Vanguard" plants adapted to sandy areas are also very numerous here. Of the seven scrub types mentioned above, four are especially well adapted to growing in the difficult conditions found in plantless areas of shifting soil (*Calligonum*, *Ammodendron*, *Eremosparton*, *Smirnovia*).

It is no exaggeration to say that the scrub barrens of Asia (and especially the western half) are richer in "vanguard" plants adapted to living in sandy areas than any other region in the world.

The scrub barrens of Asia stretch for 6,000 kilometers from Iran to the Ordos. The greatest width, at the longitude of the Aral Sea, is 800 kilometers (this width is determined in most instances by soil factors—amount of sand). The average width of this Asian zone is 200 to 250 kilometers. In Iran, the area occupied by scrub barrens is not large. However, according to Chenayakovskiy, at Shushtar City (Latitude 32°) white haloxylonates and *Ammodendron* thickets can be seen in local sandy areas. According to Chaludena well-developed black haloxylonate thickets extend to the Makran mountain range (in the Eampur valley). These writers also point out that many areas bear black haloxylonates in the eastern part of Iran and western Baluchi, at a latitude of 27° to 28° (the plain between Hamiyana, and Gowd-e-chehliyah, the Tagur plain, the Tal'aband plain, and the vicinity of Hamiyana and Mashka').

The thickets made up of black haloxylonates and *Phoenix dactylifera*, *Chamaerops ritchicena*, *Kyhop* (perhaps *Prosopis specigera*) which have been briefly described by Chaludena are unusually interesting. This type of palm-haloxylonate complex (Palmovo-Saksaupovie) is characteristic of the forests of Gushen-ye Bala, Golan, Makran, etc.

In the barrens of Iran, scrub pig-bristle plant (*Salsola arbuscula*, *S. Richteri*, *Seidlitzia rosmarinus*) and various kinds of *Tamarix* are all very widely distributed.

On the other hand, there is a very limited distribution of vanguard plants adapted to sandy areas (*Calligonum ammodendron*), and some are not present at all (*Eremosparton*, *Smirnovia*). It also appears that there cannot be a great amount of white haloxylonates.

The realm of the true white haloxylonates begins in Soviet central Asia at Kara-Kum and Kyzyl-Kum. In the central Turan lowland, south of latitude 42°, white haloxylonates and herbaceous plant cover made up of *Carex physodes* are dominant. Further to the northeast, haloxylonates and a scrub stratum of *artensia* (principally *Artemisia terrae albae* and *Eurotia ceratoides*) are dominant over a very large area.

In the scattered sandy areas of Turkmen and Uzbekistan, unusually sparse groups of *Calligonum* and *Ammodendron* are characteristic. In places where there are no sandy areas, pig-bristle plant (*Salsola lari-cifolia*) is dominant. Sometimes, however, short-lived black haloxylonate or *Reaumuria fruticosa* and *R. oxiana* (on the broken hills) may occupy a very large area. In the small scrub stratum of this type of complex, the dominant plants are *Salsola gemmascens* and some *artemisia*s (*Artemisia herbaalba*, *A. eriocarpa*, *A. santolina*).

The sandy areas of the northern part of the Asian scrub zone (near Balkhash, and a part of Muyun-kum) are very similar to sandy areas of the grass plain zone (there is much *Stipa joannis*, *Agropyrum sibiricum* and other types).

The number of short-lived and semishort-lived plants in the scrub barrens becomes gradually less toward the east, although they are still very numerous near Balkhash. The following facts are presented to explain this point: in the herbaceous stratum of the haloxylonate growth of Kara-Kum and the vicinity of Balkhash, 50 percent or more of the plants are of the same types; typical short-lived plants are *Eremoyrum*, *Malcolmia*, *Streptoloma*, *Alyssum*, etc.

Further to the east—at Guchen, the lower stratum of the barren-scrub complex consists of small scrub (*artemisia*, *yu-jo*, *ma-huang*). The scrub consists of few types—legumes (*Ammodendron*, *Eremosparton*) are not seen, scrub pig-bristle plant (*Salsola richteri*) is also unknown, and there is exceptionally little *Calligonum*. *Haloxylon aphyllum* and *H. persicum* are here replaced by another haloxylonate, *H. ammodendron*. It should be pointed out, however, that it is not yet regarded as an established fact that *H. aphyllum* is not present in Guchen (since on the basis of the organs of nourishment there is no distinction between *H. aphyllum* and *H. ammodendron*). In any event, except for small-type haloxylonates (using *H. ammodendron* as the standard), this area is lacking in tree-type haloxylonates. Lobolovskiy has recorded that there are tall tree-like haloxylonates in sandy areas along the coasts of Dzosotin-Eliste and Bagrish-Kulya. (V. P. Lobolovskiy has drawn the southern limit of the scrub barrens in this area along the 44th parallel of latitude: "South of this line not a tree is seen except for very few willows or haloxylonates.")

Tree-like haloxylonates are characteristic of this area, notably around lakes and swamps (Bagrish-Kulya, Ai-te-ching-ko-erh Edzin-Gol), while *Calligonum mongolicum* is dominant in sandy areas. Among the plants covering the gravelly plains are *Salsola arbuscula*, *S. iaricifolia*, *Haloxylon ammodendron*, *Zygophyllum xanthoxylon*, *Reaumuria soongaria*, *Caragana grandiflora*, *Salsola gemmascens*, *Artemisia frigida*.

In the barrens of central Asia there also grow a number of types of dry-growing graminaceous plants (*Stipa gobica* and others).

In the eastern part of the Asian barren-scrub zone, *Nitroa* thickets are very common in salt-swamp areas.

Further east, in the Ordos, the barrens are gradually replaced by grassy plains. In the sandy areas of the middle reaches of the Yellow River the dominant plants are juniper—*Juniperus chinensis*, and cross-flower scrub—*Pugionium cornutum*, and several shrubs—*Artemisia campestris* (?), *Lespedeza trichocarpa*, *Saussurea japonica*.

We can thus see that from a geographical botany point of view, the scrub and small-scrub barrens of Asia are made up of very many different kinds and very specialized kinds of plants. Judging on the basis of many plant classifications, almost all of the unique types of plants mentioned above have their center of development in the Turan area. We therefore believe that this completely proves the correctness of separating the Turan area from the Mediterranean plant area. Everyone knows that the latest proposals for dividing central Asia distinguish only the Iran and Mongolian areas and consider central Asia as transitional. Thus, if we take lowlands, foothills, and mountains together, the Turan plant region (and animal region also) can be considered as transitional in nature. This is especially true of the western part of Turan (up to Karatau), where the plant types of the low mountains and foothills are all clearly of an Iranian appearance. Therefore, this region can only be called the easternmost outpost of the Iran plant region. We see a different situation in the lowland barrens: They definitely do not belong to the same type as the Iran plant region. (In the Iran scrub barrens, individual areas should be regarded as part of the Turan plant region.) At the same time, the lowland barrens cannot be designated Mongolian type, although the Mongolian barrens have many plant types in common with Turan. From the Caspian Sea to the Richthofen Mountains (including Guchen), it is most suitable to designate the central Asian lowland barrens as Turan type. Coming to Mongolia itself, it should be seen as a transitional region between the Turan plant system and the grasslands of the East Asian plateau and the southern Siberian plateau.

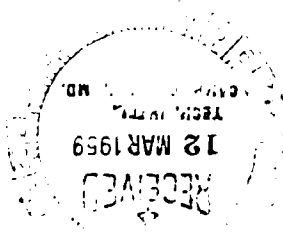
(Translated by Wang En-t'ung from the proceedings of the second Soviet Geographic Congress, Vol. 3, 1949; Han Mu-k'ang, editor)

(Figure legend)

#### TYPES OF ASIAN BARRENS

1. Small scrub barrens: (a) Northern, (b) Southern; 2. Scrub barrens;
3. Short-lived plant barrens; 4. Graminaceous plant barrens; 5. Grasslands; 6. Dry grasslands with scattered trees; 7. Forest; 8. Mountainous areas.

(The following references were used for compiling this map: The I-lang barren is mainly based on Chaludena, the central Asian barrens are based on Lobolovski and Baudaning.)



FEB 11 1959